

**CLAIMS:**

We Claim:

1. A method of offshore mooring including the steps of:

5                   providing a vessel to be moored;  
                  providing a pendant;  
                  securing the pendant to the vessel to be moored;  
                  providing a preset mooring line having a distal  
end;

10                   providing a clamping apparatus;  
                  securing the clamping apparatus between the  
preset mooring line and the pendant;

                  providing an anchor handling vessel;  
                  employing the anchor handling vessel to apply a  
15   predetermined tension between the pendant and the preset  
mooring line;

                  employing the clamping apparatus to securely  
clamp the pendant to the preset mooring line while  
maintaining the predetermined tension.

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2. The method of offshore mooring according to claim 1 wherein the step of securing the pendant to the apparatus to be moored is carried out by mounting a padeye on the vessel to be moored and connecting the pendant to the padeye.

3. The method of offshore mooring according to claim 2 including the additional step of mounting a tension measuring device on the padeye and thereby generating a signal indicative of the tension applied to the padeye by the pendant.

4. The method of offshore mooring according to claim 1 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a chain stopper and a pulley; wherein the step of providing of pendant is further characterized by providing pendant having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

5. The method of offshore mooring according to claim 4 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the chain stopper of the clamping apparatus with the chain comprising the distal end of the pendant.

6. The method of offshore mooring according to claim 5 including the additional step of employing a remote operated vehicle to engage the chain stopper with the chain comprising the distal end of the chain.

7. The method of offshore mooring according to claim 6 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

8. The method of offshore mooring according to claim 1 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a stopper arm and a pulley; wherein the step of providing of pendant is further characterized by providing pendant having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

9. The method of offshore mooring according to claim 8 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the stopper arm of the clamping apparatus with the chain comprising the distal end of the pendant.

10. The method of offshore mooring according to claim 9 including the additional step of employing a remote operated vehicle to engage the stopper arm with the chain comprising the distal end of the chain.

11. The method of offshore mooring according to claim  
10 including the additional step of employing the remote  
operated vehicle to disengage the distal end of the pendant  
from the anchor handling vessel after the clamping  
5 apparatus has been actuated.

12. The method of offshore mooring according to claim  
1 including the additional steps of deploying a remote  
operated vehicle from the anchor handling vessel; and  
employing the remote operated vehicle to actuate the  
10 clamping apparatus to securely clamp the pendant to the  
preset mooring line.

13. The method of offshore mooring according to claim  
12 wherein the step of providing a pendant is further  
characterized by providing a pendant having a distal end,  
15 and including the additional step of securing the distal  
end of the pendant to the anchor handling vessel.

14. The method of offshore mooring according to claim  
13 including the additional step of employing the remote  
operated vehicle to disengage the distal end of the pendant  
20 from the anchor handling vessel after the clamping  
apparatus is actuated.

16. The method of offshore mooring according to claim  
15 wherein the step of securing the pendant to the  
apparatus to be moored is carried out by mounting a padeye  
on the vessel to be moored and connecting the pendant to  
the padeye.

17. The method of offshore mooring according to claim 16 including the additional step of mounting a tension measuring device on the padeye and thereby generating a signal indicative of the tension applied to the padeye by the pendant.

18. The method of offshore mooring according to claim 15 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a chain stopper and a pulley; wherein the step of providing of pendant is further characterized by providing pendant having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

19. The method of offshore mooring according to claim 18 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the chain stopper of the clamping apparatus with the chain comprising the distal end of the pendant.

20. The method of offshore mooring according to claim 19 including the additional step of employing a remote operated vehicle to engage the chain stopper with the chain comprising the distal end of the chain.

5 21. The method of offshore mooring according to claim 20 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

10 22. The method of offshore mooring according to claim 15 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a stopper arm and a pulley; wherein the step of providing of pendant is further characterized by providing pendant  
15 having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.



23. The method of offshore mooring according to claim 22 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the stopper arm of the clamping apparatus with the chain comprising the distal end of the pendant.

24. The method of offshore mooring according to claim 22 including the additional step of employing a remote operated vehicle to engage the stopper arm with the chain comprising the distal end of the chain.

25. The method of offshore mooring according to claim 24 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

26. The method of offshore mooring according to claim  
15 including the additional steps of deploying a remote  
operated vehicle from the anchor handling vessel; and  
employing the remote operated vehicle to actuate the  
5 clamping apparatus to securely clamp the pendant to the  
preset mooring line.

27. The method of offshore mooring according to claim  
26 wherein the step of providing a pendant is further  
characterized by providing a pendant having a distal end,  
10 and including the additional step of securing the distal  
end of the pendant to the anchor handling vessel.

28. The method of offshore mooring according to claim  
27 including the additional step of employing the remote  
operated vehicle to disengage the distal end of the pendant  
15 from the anchor handling vessel after the clamping  
apparatus is actuated.

29. A method of offshore mooring including the steps of:

providing a vessel to be moored;

providing a pendant;

5       securing the pendant to the vessel to be moored;

providing a preset mooring line having a distal end;

providing a clamping apparatus;

10       securing the clamping apparatus between the preset mooring line and the pendant;

providing an anchor handling vessel;

providing an winch on the anchor handling vessel;

15       employing the winch on the anchor handling vessel to apply a predetermined tension between the pendant and the preset mooring line;

employing the clamping apparatus to securely clamp the pendant to the preset mooring line while maintaining the predetermined tension.

20       30. The method of offshore mooring according to claim 29 wherein the step of securing the pendant to the apparatus to be moored is carried out by mounting a padeye on the vessel to be moored and connecting the pendant to the padeye.

31. The method of offshore mooring according to claim 30 including the additional step of mounting a tension measuring device on the padeye and thereby generating a signal indicative of the tension applied to the padeye by the pendant.

32. The method of offshore mooring according to claim 29 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a chain stopper and a pulley; wherein the step of providing of pendant is further characterized by providing pendant having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

33. The method of offshore mooring according to claim 32 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the chain stopper of the clamping apparatus with the chain comprising the distal end of the pendant.

34. The method of offshore mooring according to claim 33 including the additional step of employing a remote operated vehicle to engage the chain stopper with the chain comprising the distal end of the chain.

5           35. The method of offshore mooring according to claim 34 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

10           36. The method of offshore mooring according to claim 29 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a stopper arm and a pulley; wherein the step of providing of pendant is further characterized by providing pendant  
15           having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

37. The method of offshore mooring according to claim 36 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the stopper arm of the clamping apparatus with the chain comprising the distal end of the pendant.

38. The method of offshore mooring according to claim 37 including the additional step of employing a remote operated vehicle to engage the stopper arm with the chain comprising the distal end of the chain.

39. The method of offshore mooring according to claim 38 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

40. The method of offshore mooring according to claim 29 including the additional steps of deploying a remote operated vehicle from the anchor handling vessel; and employing the remote operated vehicle to actuate the clamping apparatus to securely clamp the pendant to the preset mooring line.

41. The method of offshore mooring according to claim 40 wherein the step of providing a pendant is further characterized by providing a pendant having a distal end, and including the additional step of securing the distal end of the pendant to the anchor handling vessel.

42. The method of offshore mooring according to claim 41 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus is actuated.

43. A method of mooring a vessel at an offshore venue comprising the steps of:

providing a pendant having an end secured to the vessel to be moored and having a distal end;

5 providing a preset mooring line including an anchor secured in engagement with the sea floor and having a distal end;

providing a clamping apparatus including a clamping mechanism and a pulley;

10 securing the clamping apparatus to the distal end of the preset mooring line;

passing the distal end of the pendant through the clamping mechanism and around the pulley of the clamping apparatus;

15 applying a force to the distal end of the pendant and thereby establishing a predetermined tension between the anchor, the preset mooring line, the pendant, and the vessel to be moored;

20 actuating the clamping mechanism of the clamping apparatus to securely clamp the pendant in engagement with the preset mooring line while maintaining the predetermined tension therebetween.



44. The method of mooring a vessel at an offshore venue according to claim 43 wherein the step of applying a force to the distal end of the pendant is carried out by connecting the distal end of the pendant to a winch, and thereafter operating the winch to apply the force to the distal end of the pendant.

45. The method of mooring an apparatus at an offshore venue according to claim 44 including the additional step of mounting the winch on an anchor handling vessel.

46. The method of mooring a vessel at an offshore venue according to claim 45 including the additional steps of:

deploying a remote operated vehicle from the anchor handling vessel; and

utilizing the remote operated vehicle to actuate the clamping mechanism of the clamping apparatus.

47. The method of mooring a vessel at an offshore venue according to claim 46 including the additional step of employing the remote operated vehicle to disconnect the distal end of the pendant from the winch subsequent to actuation of the clamping mechanism.

48. The method of mooring a vessel at an offshore venue according to claim 43 further characterized by:

providing an anchor handling vessel having a propulsion system;

5           securing the distal end of the pendant to the anchor handling vessel; and

          using the propulsion system of the anchor handling vessel apply the force to the distal end of the pendant.

10           49. The method of mooring a vessel at an offshore venue according to claim 48 including the additional step of disengaging the pendant from the anchor handling vessel subsequent to actuation of the clamping mechanism.

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providing a pendant having an end secured to the vessel to be moored and having a distal end;

providing a clamping apparatus including a clamping mechanism and a pulley;

passing the distal end of the mooring line through the clamping mechanism and around the pulley of the clamping apparatus;

actuating the clamping mechanism of the clamping apparatus to securely clamp the pendant in engagement with the preset mooring line while maintaining the predetermined tension therebetween.

51. The method of mooring a vessel at an offshore venue according to claim 50 wherein the step of applying a force to the distal end of the mooring line is carried out by connecting the distal end of the mooring line to a winch, and thereafter operating the winch to apply the force to the distal end of the mooring line.

52. The method of mooring a vessel at an offshore venue according to claim 51 including the additional step of mounting the winch on an anchor handling vessel.

53. The method of mooring a vessel at an offshore venue according to claim 52 including the additional steps of:

deploying a remote operated vehicle from the anchor handling vessel; and

utilizing the remote operated vehicle to actuate the clamping mechanism of the clamping apparatus.

54. The method of mooring a vessel at an offshore venue according to claim 53 including the additional step of employing the remote operated vehicle to disconnect the distal end of the mooring line from the winch subsequent to actuation of the clamping mechanism.

55. The method of mooring a vessel at an offshore venue according to claim 50 further characterized by:

providing an anchor handling vessel having a propulsion system;

5           securing the distal end of the mooring line to the anchor handling vessel; and

          using the propulsion system of the anchor handling vessel apply the force to the distal end of the mooring line.

10           56. The method of mooring a vessel at an offshore venue according to claim 55 including the additional step of disengaging the mooring lien from the anchor handling vessel subsequent to activation of the clamping mechanism.

57. A system for mooring a vessel at an offshore venue comprising:

a pendant secured to the apparatus to be moored and extending to a distal end;

5 an anchor secured in the sea floor;

a preset mooring line extending from the anchor to a distal end;

means for applying a predetermined tension between the preset mooring line and the pendant; and

10 a clamping apparatus mounted between the preset mooring line and the pendant for securely clamping the pendant into engagement with the preset mooring line while maintaining the predetermined tension therebetween.

58. The system for mooring a vessel at an offshore venue according to claim 57 wherein the clamping apparatus  
15 includes a clamping mechanism and a pulley and wherein the distal end of the pendant extends through the clamping mechanism and around the pulley of the clamping apparatus.

59. The system for mooring a vessel at an offshore venue according to claim 57 wherein the clamping apparatus  
20 includes a clamping mechanism and a pulley and wherein the distal end of the mooring line extends through the clamping mechanism and around the pulley.

60. The system for mooring a vessel at an offshore venue according to claim 57 further including a remote operated vehicle for actuating the clamping mechanism of the clamping apparatus to securely clamp the pendant and  
5 the preset mooring line in engagement with one another.

61. The system for mooring an apparatus at an offshore venue according to claim 57 wherein the means for applying a predetermined tension between the preset mooring line and the pendant comprises a winch mounted on an anchor  
10 handling vessel and a line extending from the winch.

62. The system for mooring an apparatus at an offshore venue according to claim 61 further including a remote operated vehicle for disengaging the distal end of the line extending from the winch after the clamping  
15 apparatus is actuated.

63. The method of mooring a vessel at an offshore venue according to claim 57 further characterized by:

providing an anchor handling vessel having a propulsion system;

5           securing the distal end of the pendant to the anchor handling vessel; and

          using the propulsion system of the anchor handling vessel apply the force to the distal end of the pendant.

10           64. The method of mooring a vessel at an offshore venue according to claim 63 including the additional step of disengaging the pendant from the anchor handling vessel subsequent to actuation of the clamping mechanism.



65. The system for mooring a vessel at an offshore venue according to claim 57 wherein the clamping apparatus includes a clamping mechanism and a pulley and wherein the distal end of the pendant extends through the clamping mechanism and around the pulley of the clamping apparatus, wherein the means for applying a predetermined tension between the preset mooring line and the pendant comprises a winch mounted on an anchor handling vessel and a line extending from the winch and connected to the distal end of the pendant, and further including a remote operated vehicle for actuating the clamping mechanism of the clamping apparatus to securely clamp the pendant into engagement with a preset mooring line, and for thereafter disengaging the distal end of the pendant from the line extending from the winch after the clamping apparatus has been actuated.

66. The system for mooring a vessel at an offshore venue according to claim 57 further characterized by a line extending upwardly from the clamping mechanism and a submersible buoy secured to the end of the line for maintaining the line in a vertical orientation.

67. A system for mooring a vessel at an offshore venue comprising:

a pendant having an end secured to the vessel to be moored and having a distal end;

5 a preset mooring line including an anchor secured into engagement with the sea floor and having a distal end;

a clamping apparatus including a clamping mechanism and a pulley;

10 means securing the clamping apparatus to the distal end of the preset mooring line;

the distal end of the pendant extending through the clamping mechanism and around the pulley of the clamping apparatus;

15 means for applying force to the distal end of the pendant and thereby establishing a predetermined tension between the anchor, the preset mooring line, the pendant, and the apparatus to be moored; and

20 means for actuating the clamping mechanism of the clamping apparatus to securely clamp the pendant into engagement with the preset mooring line while maintaining the predetermined tension therebetween.

68. The system for mooring a vessel at an offshore venue according to claim 67 wherein the means for applying a force to the distal end of the pendant comprises a winch and a line extending from the winch and connected to the distal end of the pendant.

69. The system for mooring a vessel at an offshore venue according to claim 68 further including an anchor handling vessel having the winch mounted thereon.

70. The system for mooring a vessel at an offshore venue according to claim 69 further including a remotely operated vehicle for actuating the clamping mechanism of the clamping apparatus to securely clamp the pendant into engagement with the preset mooring line and for thereafter disconnecting the distal end of the pendant from the line extending from the winch.

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72. An apparatus for use in the offshore mooring of vessels comprising:

a pin;

a grooved pulley rotatably supported on the pin  
5 for receiving and directing a predetermined type of chain;

a chain guide pivotally supported on the pin and comprising a chain receiving aperture extending to a chain guiding plate;

a clamping apparatus mounted on the chain guide  
10 for normally permitting movement of a chain through the chain guide in a first direction while preventing movement of the chain through the chain guide in the opposite direction; and

a connection member pivotally supported on the  
15 pin and comprising opposed connection arms extending in opposite directions from the pin.

73. The apparatus according to claim 72 wherein the chain comprises alternating nominally vertically disposed links and nominally horizontally disposed links, and  
20 wherein the pulley comprises an inner relatively narrow groove for receiving and guiding the nominally vertically disposed links of the chain and an outer relatively wide groove for receiving and guiding the normally horizontally disposed links of the chain.

74. The apparatus according to claim 72 wherein the clamping apparatus comprises a chain stopper pivotally supported on the chain guide and normally extending into engagement with a length of chain extending through the chain guide.

75. The apparatus according to claim 72 wherein each connection arm of the connection member extends to a shackle for selectively connecting the apparatus to a line.

76. The apparatus according to claim 72 further including a remote operated vehicle for selectively disengaging the clamping apparatus from the chain and thereby permitting movement of the chain in said opposite direction.

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initially locating the vessel to be moored at a

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subsequently positioning the vessel to be moored at the predetermined offshore mooring site;

securing the pendant to the vessel to be moored;

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securing the clamping apparatus between the  
preset mooring line and the pendant;

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employing the anchor handling vessel to apply a predetermined tension between the pendant and the preset mooring line and thereby applying tension to the first mooring line;

employing the clamping apparatus to securely clamp the pendant to the preset mooring line while

maintaining tension on the line and on the first mooring line.

78. The method of offshore mooring according to claim 77 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a chain stopper and a pulley; wherein the step of providing of pendant is further characterized by providing pendant having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

79. The method of offshore mooring according to claim 78 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the chain stopper of the clamping apparatus with the chain comprising the distal end of the pendant.

80. The method of offshore mooring according to claim 79 including the additional step of employing a remote operated vehicle to engage the chain stopper with the chain comprising the distal end of the chain.



81. The method of offshore mooring according to claim 80 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

82. The method of offshore mooring according to claim 77 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a stopper arm and a pulley; wherein the step of providing of pendant is further characterized by providing pendant having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

83. The method of offshore mooring according to claim 82 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the stopper arm of the clamping apparatus with the chain comprising the distal end of the pendant.

84. The method of offshore mooring according to claim 83 including the additional step of employing a remote operated vehicle to engage the stopper arm with the chain comprising the distal end of the chain.

5           85. The method of offshore mooring according to claim 84 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

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86. For use in conjunction with a mooring installation of the type comprising a plurality of mooring lines secured to the vessel at spaced points around the periphery thereof and characterized by a predetermined storm resistance rating, a method of increasing the storm resistance rating of the mooring installation including the steps of:

providing at least one pendant;

securing the pendant to the moored vessel;

providing at least one preset mooring line having a distal end;

providing a clamping apparatus;

securing the clamping apparatus between the preset mooring line and the pendant;

providing an anchor handling vessel;

employing the anchor handling vessel to apply a predetermined tension between the pendant and the preset mooring line;

employing the clamping apparatus to securely clamp the pendant to the preset mooring line while maintaining the predetermined tension.

87. The method of offshore mooring according to claim 86 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a chain stopper and a pulley; wherein the step of providing of pendant is further characterized by providing pendant having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

88. The method of offshore mooring according to claim 87 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the chain stopper of the clamping apparatus with the chain comprising the distal end of the pendant.

89. The method of offshore mooring according to claim 88 including the additional step of employing a remote operated vehicle to engage the chain stopper with the chain comprising the distal end of the chain.

90. The method of offshore mooring according to claim 89 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

91. The method of offshore mooring according to claim 86 wherein the step of providing a clamping apparatus is carried out by providing a clamping apparatus comprising a stopper arm and a pulley; wherein the step of providing of pendant is further characterized by providing pendant having a distal end; and including the additional step of directing the distal end of the pendant through the chain stopper and around the pulley of the clamping apparatus.

92. The method of offshore mooring according to claim 91 wherein the step of providing a pendant having a distal end includes the step of providing a chain at the distal end of the pendant, and wherein the step of employing a clamping apparatus to securely clamp the pendant to the preset mooring line is carried out by engaging the stopper arm of the clamping apparatus with the chain comprising the distal end of the pendant.

93. The method of offshore mooring according to claim 92 including the additional step of employing a remote operated vehicle to engage the stopper arm with the chain comprising the distal end of the chain.

5           94. The method of offshore mooring according to claim 93 including the additional step of employing the remote operated vehicle to disengage the distal end of the pendant from the anchor handling vessel after the clamping apparatus has been actuated.

10           95. The method of offshore mooring according to claim 86 including the additional steps of deploying a remote operated vehicle from the anchor handling vessel; and employing the remote operated vehicle to actuate the clamping apparatus to securely clamp the pendant to the  
15           preset mooring line.

20           96. The method of offshore mooring according to claim 95 wherein the step of providing a pendant is further characterized by providing a pendant having a distal end, and including the additional step of securing the distal end of the pendant to the anchor handling vessel.

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